1. 3rd year milestones on Photo-cathode theory/simulation

1) Building a theory/simulation model of diffusion of the PC materials in the amorphous or polycrystalline films that will be related to macroscopic properties: structure, stresses, and chemical composition.

Phase diagram
Thermal, electrical, structural properties
Electron boundary scattering

2) Model of crystalline structure of the film, effect of texturing on the electric and thermal properties of the PC

3) Model of interstitial and vacancy diffusion at the grain boundary – diffusion coefficients, temperature effects.

4) Obtain the physical parameters of the PC materials: electron escape length, ionization potentials.

2. 3rd year milestones on MCP theory/simulation

1) In addition to plotting measurable MCP variables such as gain and timing, simulations should provide distributions of kinematic variables corresponding to strikes within the pores, such as number of strikes, striking angles, and striking energies.

2) A major focus for this subcontract will be on optimizing the time resolving capabilities of MCP configurations. We would like to identify the top three parameters from among all degrees of freedom -geometry, composition, voltages- that have the biggest impact on timing.

3) Another focus of this subcontract will be on understanding the role of backscattering in MCP performance. We would like to identify the most sensitive observables to backscattering models and use data comparisons of these observables to exclude or constrain BS models.

4) We would like to understand the impact of saturation on the gain, timing, and dynamic range of the MCPs. MCS should make predictions regarding how plate resistivity and SEY should affect these MCP properties. MCS should also produce relaxation time predictions that could be compared with experimental data.

5) MCS should be used to examine the role of end-spoiling in tuning the spatial and timing distributions of electrons exiting the MCP pore.

Code development goals

- MCS should be capable of simulating avalanches in funnel geometry for different pore lengths, pore radii, and funnel sizes, as well as variations in pore length, pore diameter, and bias angle in the standard MCP geometry

- the code should also be capable of simulating thin-film SEY layers, such as a carbon foil, between the various stages of the MCP stack

- MCS currently generates a fixed number of secondary electrons for a given striking energy, corresponding to the average SEY. MCS should allow for statistical fluctuations about the mean SEY for at least the first few strikes.